REMARKS

The application has been amended and is believed to be in condition for allowance.

The Official Action objected to claim 24 due to an informality. Responsively, claim 24 has been amended so as to correct the noted informality.

Applicant acknowledges with appreciation that the Official Action indicated that claims 5, 8, 14, and 22-24 were directed to allowable subject matter. In reliance thereupon, the claims have been amended so as to recite the features of the invention indicated to patentably recite the present invention.

Presently, claims 1, 5, 8, 14, 18, and 23-24 are independent. Claims 4, 10-13, 15-17, and 22 have been canceled. Claims 2-3 depend from claim 1, claims 6-7 and 9 depend from claim 5, and claims 19-21 and 25 depend from claim 18.

Reference is made to page 11 of the Official Action in which the reasons for allowance of claims 5, 8, 14, and 22-24 are given. In this passage, there appears to be three features which individually render the claims allowable. Feature 1 is that the fixed end of the lead must be in contact with the solder balls and also with the surface of the insulating sheet (OA page 11, lines 9-12). Feature 2 is that the holes must be filled with a resin in such a manner that a space between the solder balls is free of resin (page 11, lines 9-12). Feature 3 is that a grid

array of connection pads of the wiring substrate must be out of vertical alignment with that of the solder balls (page 11, line 7).

Allowable claim 5 has been amended to include the recitations of all of claims 1-4. Accordingly, allowance of claim 5 and the claims depending therefrom is respectfully requested. Claims 1 and 8 have also been amended and are based on the recitations of allowable claims 5 and 8, respectively. Certain recitations of intermediate claims 2-3 not believed to be relevant to the patentable features of the claims have been omitted.

Dependent claim 3 has been amended to include the recitations of allowable claim 8.

Claims 12-13 have been canceled and claim 14 has been amended to include the recitations of claim 12 only. The recitations of intermediate claim 13 are not believed to be relevant to the patentability of claim 14.

Allowable claims 23 and 24 have been amended to be in independent form including the recitations of independent claim 18. The recitations of intermediate claims 19 and 21 have been omitted as they do not pertain to the patentable features.

Similarly, independent claim 18 has been amended to include the recitations of allowable claim 22, claim 22 being

canceled. Claim 21 has been amended to depend directly from claim 18.

The claims having been amended to include the features indicated to patentably recite the present invention, allowance of all the independent claims as well as the claims depending therefrom is respectfully requested.

Feature 1 of the present invention as defined by claims 1, 5, 14, 18, and 24 lies in an insulating sheet having leads, wherein the leads connect solder balls of a semiconductor chip and connection pads of wiring board, and an end of each lead is fixed on a first surface of the insulating sheet and is in contact with a corresponding one of solder balls of the semiconductor chip.

According to the present invention with Feature 1, sufficient connection strength between the solder balls of the semiconductor chip and the insulating sheet can be maintained, and the semiconductor chip can be easily detached from the insulating sheet after the semiconductor chip is mounted on the insulating sheet. Thus, high maintainability of the semiconductor chip is ensured.

Furthermore, the stress caused by a difference of coefficient of thermal expansion of the semiconductor chip and the wiring board can be absorbed by the insulating sheet and the leads with resilience. Therefore, disconnection at the solder

balls is prevented and high reliability of the connection between the semiconductor chip and the wiring board is realized (page 9, lines 7-22).

Feature 2 of the present invention as defined by claims 8, 23, and 24 lies in the resin filling a gap between the insulating sheet and the wiring substrate keeping the gap between the solder balls free of resin.

According to the present invention with Feature 2, the stress caused by a difference of coefficient of thermal expansion of the semiconductor chip and the wiring board can be absorbed, and the connection between the leads and the connection pads of the wiring board can be ensured without covering the solder balls with resin. Therefore, the semiconductor chip can be easily detached from the insulating sheet after the semiconductor chip is mounted on the insulating sheet, so that high maintainability of the semiconductor chip is also ensured (page 12, lines 7-18).

The cited reference, KHANDROS et al. 5,148,266, discloses a semiconductor chip assembly with an interposer 42 arranged between a semiconductor chip 28 and solder balls 52. However, chip assemblies of the present invention and the KHANDROS reference are in an opposite configuration in terms of the positions of the interposer 42, the free end of the flexible lead 50, and the resin or an encapsulant 60.

Specifically, in KHANDROS, the interposer 42 is attached to the semiconductor chip 28 instead of the substrate 20. The free ends of the flexible lead 50 are connected to the electrical contacts 40 of the semiconductor chip 28 instead of the contact pads 24 of the substrate 20. An encapsulant 60 is filled in apertures 54 to cover the contact 40 of the semiconductor chip 28 instead of the contact pads 24 of the substrate 20 (Figure 2).

In this way, KHANDROS discloses none of Features 1 and 2 of the present invention. Without Features 1 and 2 in KHANDROS, the semiconductor chip cannot be detached from the assembly easily because the contacts 40 of the chip is placed in the apertures 54 of the interposer 42 and covered by encapsulant 60. Also, the solder balls are directly subject to the stress caused by a deformation of the substrate which is larger than the stress caused by deformation of the semiconductor chip, since the solder balls are in contact with contact pads 24 on substrate 20.

The Official Action states that it would have been obvious to incorporate the chip provided with a plurality of solder balls as taught by MIYAZAKI et al. 6,342,726 so that the interconnect integrity, strength and reliability can be improved in KHANDROS' structure (page 5, line 18 to page 6, line 2). However, applicant believes that such a modification would have never been obvious for the following reasons.

If the semiconductor chip of KHANDROS is provided with solder balls of MIYAZAKI, the most part of the flexible lead 50 is covered by the rigid solder ball, and thus, the leads 50 would lose flexibility. This would render the prior art of KHANDROS unsatisfactory for its intended purpose of permitting the displacement of the contact of the semiconductor chip by the flexibility of the lead (column 7, lines 53-67).

Additionally, none of the KHANDROS and the MIYAZAKI references discloses a resin covering pads on a substrate (Feature 2). In MIYAZAKI, the resin or the sealant 6 covers the pads 7 of the semiconductor chip 1 (Figure 2). Since both of the cited references are silent as to Feature 2, there is no suggestion or motivation to modify KHANDROS' structure to have this feature.

As stated above, it would never be obvious to the person skilled in the art to arrive at the aforementioned features of the present invention. Therefore, in addition to the reasons stated on page 11 of the Official Action, for these further reasons, all claims are believed to be patentable.

Applicant believes that the present application is in condition for allowance and an early indication of the same is respectfully requested.

Please charge the fee of $172 for the two extra independent claims added herewith to Deposit Account No. 25-0120.

The Commissioner is hereby authorized in this, concurrent, and future replies, to charge payment or credit any overpayment to Deposit Account No. 25-0120 for any additional fees required under 37 C.F.R. §1.16 or under 37 C.F.R.§1.17.

Respectfully submitted,

YOUNG & THOMPSON

Roland E. Long, Jr., Reg. No. 41,949
745 South 23rd Street
Arlington, VA 22202
Telephone (703) 521-2297
Telefax (703) 685-0573
(703) 979-4709

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